REMARKS

This responds to the Office Action dated July 17, 2006, and the references cited therewith.

No claims are amended herein. Claims 1-10 and 12-20 are now pending in this application.

Double Patenting Rejection

Claims 1-10 and 12-20 were rejected on the ground of nonstatutory obviousness-type double patenting as being unpatenable over claims 6 and 20 of U.S. 2004/0049237 (now issued as U.S. Patent No. 7,092,757), which corresponds to U.S. Patent No. 7,092,757, in view of WO 00/78391, which corresponds to U.S. Patent No. 6,278,894. A terminal disclaimer is submitted herewith to overcome the rejection.

§103 Rejection of the Claims

Claims 1-20 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Hartley et al. (U.S. Patent No. 6,161,042) in view of Salo et al. (WO 00/78391), which corresponds to U.S. Patent No. 6,278,894. The rejections are traversed and reconsideration is respectfully requested.

In the previous office action, the Examiner rejected claims 1-20 under section 103 as being unpatentable over Hartley et al. in view of Salo et al. by asserting that the Hartley et al. reference disclosed filtering the voltage sense signals into the ventilation band in order to detect a noise level during a noise detection operation, citing col. 12, line 11 to col. 13, line 13 of the reference. Applicant pointed out in response that this was not correct. As stated previously, the cited portion of the Hartley reference only describes noise being detected in the signal that is output from demodulator 415 while no excitation current is supplied. There is no suggestion in the reference for further filtering the demodulated signal when no excitation current is supplied into the ventilation band by means of, for example, bandpass filter 420. The Examiner in the present Office Action, however, has asserted that the adjustable gain of the demodulator 415 somehow amounts to a filter for filtering the noise signal into the ventilation band. It is not at all

clear to Applicant how this could be so. Adjusting the gain of the demodulator 415 alters its sensitivity but does not change its filtering characteristics. There is thus no way that the gain of the demodulator 415 could be adjusted to filter the noise signal into the ventilation band, and the Hartley et. al reference does not suggest otherwise. Furthermore, at col. 12, lines 21-24, the Hartley et. al reference states that " demodulator 415 is capable of sensing noise that is at frequencies close to the 25 kilohertz carrier frequency of the current pulses 301-304." This would seem to clearly indicate that the noise signal output from the demodulator 415 during a noise detection operation as taught by the Hartley et al. reference is not filtered into the ventilation band since, as defined in the present application according to one embodiment, the lower and upper cutoff frequencies for the ventilation band are on the order of 0.1 and 1 Hz, respectively.

The Examiner's assertions regarding the filtering operation of the demodulator 415 suggest that it might be helpful to offer a more detailed theoretical explanation as to how it works. The voltage sense signal can be thought of as made up of two superposed components: an impedance signal component due to the voltage drop between the sense electrodes caused by the excitation current field in the thoracic volume conductor, and an external field component due to the impression of additional electric fields from noise sources such as the heart or electronic devices outside the body. It is only the impedance signal component that is of interest in measuring minute ventilation, and the external field component is unwanted noise distortion. The demodulator 415, as disclosed in the Hartley et. al reference and the present application, operates as a high pass filter with respect to the external field component of the voltage sense signal and as a low pass filter with respect to the impedance signal. The high pass filter operates to remove external field noise below its cutoff frequency, and the low pass filter removes the high frequency carrier. During normal operation, the demodulator 415 samples the voltage sense signal while excitation current is injected and computes a moving average of an even number of samples with filter coefficients that alternate in sign. It thus operates as a high pass FIR filter with a maximum pass frequency at a frequency equal to half the sampling rate, sometimes called the Nyquist frequency. The filter therefore effectively removes frequency components of the voltage sense signal that are appreciably lower than the Nyquist frequency. This is desirable in the case of the external field component of the voltage sense signal, but not so for the impedance

signal since that is where the ventilation band is. By sampling the voltage sense signal during successive phases of a bipolar excitation current waveform, however, so that the polarity of the excitation current varies with the sign of the filter coefficient used to compute the moving average, the moving average of the impedance signal component becomes a low pass filter with respect to the impedance signal instead of a highpass filter. The result of sampling and filtering a bipolar excitation current waveform is thus the effective removal from the voltage sense signal of external field noise below the Nyquist frequency without distortion of the impedance signal. In an embodiment described in the present application, the voltage sense signal is sampled during each phase of a 25 kHz bipolar excitation current waveform at a sampling rate of 50 kHz and moving averaged over four samples. The Nyquist frequency in that case is thus equal to the excitation frequency of 25 kHz and is well above the upper ventilation frequency of about 1 Hz so that any external field noise within the ventilation band is removed from the voltage sense signal samples.

During a noise detection operation, the demodulator 415 operates as described during normal operation except that no excitation current is supplied so that there is no impedance signal component. It is thus only the external field component of the voltage sense signal that is measured during a noise detection operation, and that external field component is high pass filtered as described above. As pointed out, the high pass filtering leaves only external field noise that is not appreciably below the maximum pass frequency of 25 kHz and is thus not external field noise in the ventilation band. The strobing operation of the demodulator, however, effectively downsamples the continuously moving averaged samples at a sampling rate equal to the strobing frequency. In the particular embodiment described in the present application, the strobing frequency is 20 Hz, where each strobe is made up of two cycles that are sampled during each phase to give four samples. The demodulator 415 then computes a weighed average of the samples of each strobe using highpass filter coefficients as described above to remove external field noise. Any frequency components of the external field noise that are above the Nyquist frequency for the strobe sampling operation (i.e., half the strobing frequency) and not removed by the high-pass filtering of the demodulator, however, will be aliased to lower frequencies, including possibly the ventilation band where they will produce distortion of the derived ventilation signal. It is this component of the external field noise that is detected when the

voltage sense signals during a noise detection operation are filtered into the ventilation band. The presently claimed devices and method relate to configuring the voltage sense electrodes based upon an average noise level computed from external field noise signals that have been filtered into the ventilation band to reflect what effect the noise signals would have upon normal operation. Applicant does not believe such is taught or suggested by the prior art of record.

The Examiner asserts another ground of rejection with respect to device claims 1-10 and 12. As best understood, the Examiner is suggesting that since the device disclosed by the Hartley et. al reference filters the output of the demodulator 415 into the ventilation band using bandpass filter 420 during normal operation, it is also capable of doing so during a noise detection operation. The Examiner then asserts that there is thus no structural difference between the device claimed by Applicant and what is disclosed in the Hartley et. al reference, only a different intended use. Applicant does not dispute that the mere recitation of an intended use cannot patentably distinguish a claimed structure from a prior art structure. That, however, is not the case with the present claims. Claims 1-10 and 12 recite devices that are structurally different from what is disclosed in Hartley et. al. In order for the Hartley et. al device to filter the output of the demodulator 415 into the ventilation band during a noise detection operation, it would have to be *structurally* modified. Even if such modifications were to only entail modifying the programming of a device controller to perform such filtering during a noise detection operation, those are structural modifications because they involve physically changing the memory locations in which the code for performing certain functions during a noise detection operation are located. Applicant believes that the Examiner has confused the functional limitations recited by claims 1-10 and 12 with statements of intended use. A functional limitation is an attempt to define something by what it does, rather than by what it is (e.g., as evidenced by its specific structure or specific ingredients). There is nothing inherently wrong with defining some part of an invention in functional terms. *In re Swinehart*, 439 F.2d 210, (CCPA 1971). A functional limitation must be evaluated and considered, just like any other limitation of the claim, for what it fairly conveys to a person of ordinary skill in the pertinent art in the context in which it is used. MPEP 2173.05(g). As described above, the devices recited by claims 1-10 and 12 are physically different from the device disclosed in the Hartley et al. reference. The most informative way of conveying to those of ordinary skill in the art what those

differences are is to describe the circuitry in functional terms. That is what Applicant has done in claims 1-10 and 12.

Dependent claims 2-10 and 14-20 add particular limitations to the patentable subject matter recited by claim 1 or 13, respectively, which limitations are asserted be neither taught nor suggested by the cited references in that context. For the reasons stated above and the remarks made in response to the previous Office Action, Applicant respectfully submits that claims 1-10 and 12-20 are patentable over the prior art of record.

CONCLUSION

Applicant respectfully submits that the claims are in condition for allowance, and notification to that effect is earnestly requested. The Examiner is invited to telephone Applicant's attorney at (847) 432-7302 to facilitate prosecution of this application.

If necessary, please charge any additional fees or credit overpayment to Deposit Account No. 19-0743.

Respectfully submitted,

SCOTT FREEBERG

By his Representatives,

SCHWEGMAN, LUNDBERG, WOESSNER & KLUTH, P.A.
P.O. Box 2938
Minneapolis, MN 55402
(847) 432-7302

Date 11-17-06 By [signature]
J. Kevin Parker
Reg. No. 33,024

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Paula Juchny

Name

[signature]

Signature